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Development Of The Angren Coal Deposit, Prone To Spontaneous Combustion

Akbarov Tahirjan Gulyamovich
Professor Tashkent State Technical University Named After Islam Karimov, Tashkent, Republic Of Uzbekistan

Israilov Mansurjon Abdusamatovich
Senior Lecturer Tashkent State Technical University Named After Islam Karimov, Tashkent, Republic Of Uzbekistan

Makhmudov Dilmurod Rakhmatjonovich
Head Of Department Professor Tashkent State Technical University Named After Islam Karimov, Tashkent, Republic Of Uzbekistan

Mardonov Isomiddin Nurullayvich
Senior Lecturer Tashkent State Technical University Named After Islam Karimov, Tashkent, Republic Of Uzbekistan

ABSTRACT

The article discusses the features of the development of powerful coal seams prone to spontaneous combustion. The conditions for the development of coal self-ignition processes and ways to combat endogenous fires, most of which occur in the developed space of mines. The increase in the volume of mined-out space and depth of mining operations, as well as the lack of accurate methods for determining the location of fires, reduced the effectiveness of the fight against spontaneous combustion supply of liquid compounds such as water and clay pulp flowing down the soil layer. For the prevention and suppression of foci of spontaneous combustion is increasingly being used as a nitrogen supply which produces a three-dimensional processing of the milled mass and reduces the oxygen concentration in the produced space.

KEYWORDS

Coal seams, spontaneous combustion, tectonics, disjunctive, endogenous fires, egzogenic fires, nitrogen. endogenous fires, spontaneous combustion of coal, chemical process, chemical reactions, geological features of coal, chemical activity of coal, sorption rate constant, coal metamorphism, air inflow, heat exchange, solar radiation, water injection, effective porosity coefficient, pressure gradient.

INTRODUCTION

Fires are the most common and dangerous to human life, the accidents, during which the possible poisoning and suffocation combustion products. A significant danger is

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caused by concomitant phenomena-gas and dust explosions, as well as breakouts of clay pulp. Gas explosions caused by fires, although not frequent, are very dangerous. In gas mines, they occur after the installation of jumpers that isolate the fire station. At the same time, due to the cessation of air flow, the methane concentration in the fire area increases. If it reaches the explosive limit, an explosion will inevitably occur. This explosion not only destroys the insulating lintels, but is extremely dangerous for people in the vicinity. Fire gas explosions are much less common. They occur mainly when a fire source is very active in the initial stage of its extinguishing. Breakthroughs of clay pulp in existing workings are more dangerous for people's lives than the fires themselves. Clay in the form of a liquid-flowing pulp is supplied in large quantities to underground workings for fire prevention and extinguishing.

METHODOLOGY

In the voids of old workings, it settles and partially dehydrates, but can still retain significant fluidity for a long time. As a result of movements in the mountain range, this water-clay mass can break into the existing workings below. At the same time, an interesting phenomenon called thixotropy is observed, when as a result of movement, the water-clay mass liquefies and becomes less viscous. This favors its spreading over long distances. The breakthrough and spreading of the water-clay mass occurs very quickly, and people caught by it often die, as it is almost impossible to get out of it. The damage caused by mine fires is not limited to the cost of extinguishing them. A fire that occurs in small or large scale does not always interfere with the normal operation of the enterprise-it causes downtime and a decrease in production. In the areas of fire stations, reserves are lost, coal for the preparation of which capital investments have been spent. After extinguishing the fire, it is usually necessary to restore the underground workings at the fire station-cleaning of clay and debris, re-fastening, and sometimes sinking new preparatory workings. Exogenous fires are much more dangerous for people than endogenous ones. This is due to the fact that they occur in existing workings and develop rapidly - the danger is created as a result of rapid poisoning of the mine atmosphere with fire gases. Endogenous fires most often originate in inaccessible places and develop slowly. Therefore, there are almost no human casualties from them, if they are not accompanied by side complications-gas explosions and clay pulp breakouts. One of the main factors influencing the choice of a system for developing powerful coal seams is the risk of underground fires from spontaneous combustion of coal, i.e. fires of endogenous origin. For coal mines, spontaneous combustion is affected by the following factors: power, angle, falls, smoothness and indecision of layers: the nature of the host rocks, the presence of carbonaceous rocks, and the proximity of the earth's surface. The main ones of the mining engineering factors are: the method of opening the mine field, the method of preparing the excavation fields and blocks, the cleaning system, the ventilation system and mode. The influence of geological and mining factors on the nature, shape and size of accumulations and their air permeability in coal mines is clearly defined and their significance is evaluated from the standpoint of the theory of spontaneous combustion by Prof. V.V. Veselovsky.

RESULTS

Open-pit mining of coal deposits is fundamentally different from underground mining. During open-pit mining, the layers are under conditions of unloading from rock pressure, which has a significant impact on the conditions for the formation of accumulations of oxidizing material, air flow to them, and heat accumulation conditions. In the conditions of mines, the system and mode of ventilation are determined by forced ventilation. and, in the conditions of quarries, by climatic factors. In the conditions of mines, the system and mode of ventilation are determined by forced ventilation, in the conditions of quarries, by climatic factors. Opening, preparation and maintenance system of mining in the quarries are fundamentally different from those in conditions of mines. Consequently, the role and significance of geological and mining factors in the occurrence of fires from spontaneous combustion will be different than in mines. The role and significance of the factors that affect the spontaneous combustion of coal in quarries have not been sufficiently studied and studied in the literature so far, which makes it difficult to develop methods for fighting endogenous fires. Therefore, the study of the influence of geological and mining factors on the occurrence and development of endogenous fires in the conditions of brown-coal Angren quarries is an urgent task and is the subject of research in this paper. Coals of all brands are prone to spontaneous combustion to varying degrees. Pyrite inclusions in the coal bed, as well as the humidity of coal, indirectly increase its spontaneous combustion.

DISCUSSIONS

Endogenous fires occur more frequently in the development of high-power reservoirs than in the development of thin and medium-power reservoirs. Areas of coal seams near tectonic faults are often filled with coal fines that are prone to spontaneous combustion. Therefore, endogenous fires occur more often in places of tectonic disturbances of layers than in places with a calm and correct occurrence. In safety pillars of small size or with sharp corners, as a result of rock pressure, a network of through cracks filled with fine coal is formed after some time. Source of endogenous fires in pillars occur due to air infiltration through these cracks. The tendency of a coal seam to self-ignite is one of the main factors of the potential danger of endogenous fires in specific mining-geological and mining-technical conditions of the mine field. It is determined at least once every 5 years. Coals are divided into three categories according to their propensity to self-ignite: not inclined, inclined and very inclined. Categorization is performed by the institutes for work safety, which regulates the list of source materials that must be submitted to assess the propensity of a coal seam to self-ignite at the stages of exploration and mining of the mine field. When developing coal seams, especially powerful ones, with the collapse of side rocks, the loss of coal, and therefore the possibility of endogenous fires, is greater than when developing with a full backfill. In addition, when developing with the collapse of side rocks due to their displacement, it is difficult to isolate the waste areas. Fires that occur in the developed space during the development of steep layers, especially powerful ones, are fed by the penetration of air from the surface or in the opposite direction, if as a result of the collapse of rocks, cracks or dips are formed that reach the earth's surface. The resulting fire from the upper floor can be " skipped " to the lower one during the development of the latter, since as a result of the movement of the side rocks, the safety pillars and fire zone left to isolate the fire section of the upper floor can be destroyed. Self-heating and spontaneous combustion of coals does not begin immediately after the accumulation of coal fines, loosening of coal and the formation of cracks in the pillars or mass of coal and sufficient air flow to it, but after some time-the so-called incubation period. The process of self-ignition of coal is affected by the speed of movement of the treatment face: the lower this speed, the longer the air enters the developed space and the more often self-destruction of side rocks is possible. In the latter case, when preparing a new treatment face, it is sometimes necessary to leave coal and small coal in the developed space. In addition, a long stop of lavas and the preparatory workings that serve them, if they are not properly fixed, can lead to crushing of safety pillars near these workings. Therefore, the duration of the incubation period and the rate of movement of the treatment faces should be taken into account when solving the problem of the size of the excavation sites, fields and panels. The physical conditions of spontaneous combustion of coal are: its chemical activity, the presence of accumulations of crushed coal in the developed space or a developed network of cracks in the pillars and massif, air flow and difficult heat transfer to the environment. In the process of spontaneous combustion of coal, there are three stages: self-heating, spontaneous ignition and combustion.

Based on the physical conditions of spontaneous combustion of coal, the main measures to prevent them are as follows:

- Development of reservoirs should be carried out without leaving pillars and crushed coal in the developed space.
- Do not allow air leaks through the developed space.
- Terms of working out of excavation sites should be less than the duration of the period of spontaneous combustion of coal.

Spontaneous combustion of coal is a serious problem all over the world, however, thanks to large-scale research in the field of fire fighting and implementation of preventive measures, the number of spontaneous combustion of coal has been significantly reduced and a lot of experience has been accumulated in fighting endogenous fires. In case of non-target excavation, the protection of excavation workings should be made with rubble strips or workings should be carried out on burden. It is forbidden to carry out the main mine workings (inclined shafts, incline, slopes, main and group drifts) on layers that are prone to spontaneous combustion of coal, they should be located on empty rocks. Places where field workings are laid should exclude the possibility of outcropping when they are re-anchored. The distance from the lower layer of the formation to the field group development is recommended to be at least 15 m normal from the formation. It is allowed to conduct group drifts, site inclined workings with a close arrangement of layers along the underlying layer, the coal of which is not prone to spontaneous combustion. It is forbidden to carry out workings close to the

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developed space. When leaving coal pillars between the worked-out space of the operating treatment face and the ongoing development, their width should be such that they are not destroyed by mountain pressure, but should not be less than 20 m. In cases where pillars is forced to be left in places of geological disturbances, they should be treated with anti-pyrogens or isolated with gypsum or pise-walled "shirts" 0.3–0.5 m thick and outlined with organ support or a rubble strip 5-6 m wide. Cleaning operations must be carried out in such a way as not to leave crushed coal in the developed space. On steep layers, coal moving under its own weight remains on the support (especially on fires) and must be carefully removed. To prevent air leaks through the developed space, it is necessary to use, as a rule, column systems of development with a return flow scheme for ventilation on the coal mass. If the conditions of ventilation require illumination of the outgoing jet, then it is necessary to carefully isolate the developed space using rubble strips, chock walls or" shirts " made of foam.

CONCLUSION

In the development of thick layers increase the loss of coal. Under the influence of mountain pressure, the pillars are deformed to form significant loose masses. Coal seams with a thickness of less than 2 m are considered low-risk, from 2 to 3.5 m - moderately dangerous, and more than 3.5 m- dangerous for spontaneous combustion. There is a known method for developing powerful coal seams, including carrying out preparatory workings on the soil of the formation and working off the formation with the release of an under-roof pack of coal. Disadvantages of this method are large losses of coal in the developed space, the risk of spontaneous combustion, the possibility of dynamic impacts and damage to the support during sudden precipitation of the roof due to the lack of a protective pack of coal. A method is known for working out powerful layers with inclined layers in descending order, including the excavation of the upper layer with laying after the movement of the longwall face of the flexible overlap and the subsequent excavation of layers under the protection of the flexible overlap (see Fig. 1). The disadvantages of this method are the high labor intensity of work associated with laying flexible floors and the need for layer-by-layer workings in each layer. A method is known for developing powerful flat layers of minerals with hard-to-break rocks, two inclined layers. Its essence lies in the fact that the development of a powerful reservoir is produced in two layers, that is ahead of the bottom upper on the value of the span of the collapse of the main roof, and the testing of both layers produce mechanized complexes of various size develop on the lower layer, which repay after the top layer. The disadvantages of this method are: the inability to excavate a powerful reservoir in more than two layers, which sharply limits the scope of its application, as well as the great difficulties and costs associated with maintaining the development behind the longwall face of the first layer, i.e. in particularly difficult conditions, when it is located in the zone of the total reference pressure from the long wall face of the upper and lower layer, as well as the need to use complexes of various types with different extracted layer thickness. In cases where the use of a post mining system is difficult due to mining and geological or technical conditions, it is allowed to use a solid one, but reliable isolation of the developed space is necessary, as shown in Fig. 1. a.

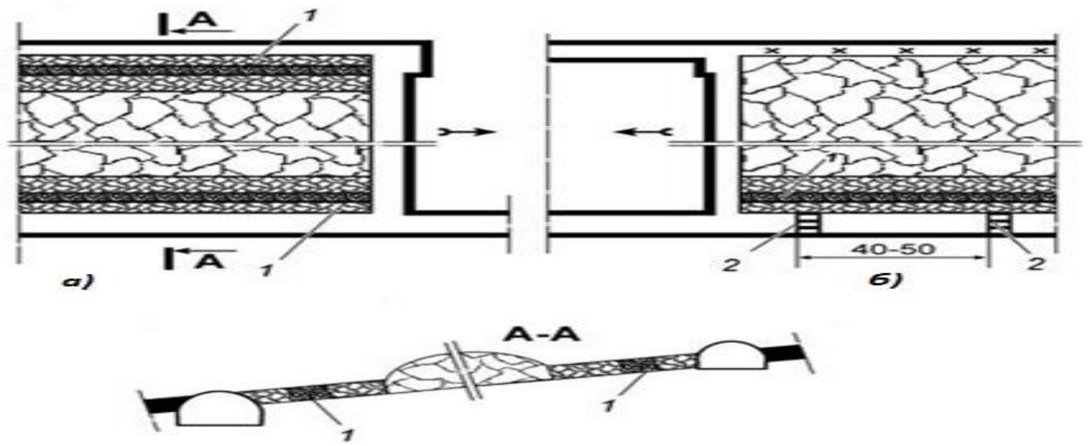

Fig. 1. Isolation schemes of the developed space: a-for a solid development system; b - for a post development system with the reuse of the former transport drift as a ventilation one:

1-insulation strip; 2-insulation seal.

The same insulation is necessary for the post system of development in the case of re-use of the former transport workings as ventilation (Fig. 1 b).

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